LAGUNA ATASCOSA NATIONAL WILDLIFE REFUGE

SOUTH TEXAS REFUGE COMPLEX

PROPOSED RE-FLOODING AND RESTORATION OF BAHIA GRANDE

FINAL DRAFT

ENVIRONMENTAL ASSESSMENT

In 1998 and 1999, the U.S. Fish and Wildlife Service bought privately owned lands surrounding the Bahia Grande wetland complex. The primary reasons for restoring this wetland system are:

- to provide nursery areas and habitat for aquatic organisms such as shrimp, crabs, and finfish
- to provide habitat for migratory wildlife such as water birds
- to reduce Bahia Grande as a source of windblown dust
- to provide increased public recreational areas

30-DAY PUBLIC COMMENT PERIOD: AUGUST 4 - SEPTEMBER 5, 3003

Please send written comments to:

South Texas Refuge Complex
Rt. 2, Box 202-A
Alamo, Texas 78516

or e-mail comments to:

FW2_RW_Laguna@fws.gov

A PUBLIC MEETING IS SCHEDULED TO PROVIDE INFORMATION AND TO SOLICIT PUBLIC COMMENTS:

- Thursday, August 14, 2003
- 5:00 p.m. to 9:00 p.m.
- Port Isabel High School - Cafeteria
- Located on State Highway 100 just east of Laguna Heights, Texas

Return to Laguna Atascosa National Wildlife Refuge website

FINAL DRAFT

SUMMARY

The U.S. Fish and Wildlife Service proposes to restore tidal flow to the Bahia Grande wetland complex, a portion of the Bahia Grande Unit of the Laguna Atascosa National Wildlife Refuge. The Bahia Grande Unit covers 21,762.451 acres of land at the present time, including bay, basins, lomas, low-lying flats, resacas, and native brush. The Bahia Grande, historically a shallow bay, is the major wetland feature on the unit and consists of approximately 6,500 acres. The bay is ephemeral in nature and is covered with water only following extreme rainfall events or tropical storm surges. The majority of time, the basin remains dry. The project area is shown in Figure 1.

The Bahia Grande Unit is located in Cameron County west of Port Isabel, Texas. Part of the Tamaulipan Biotic Province, this unit of the refuge is close to the Gulf of Mexico and consists of wind tidal flats and high ground that includes brush covered clay dunes (lomas) that attain heights of up to 30 feet. This matrix of stabilized clay dunes is interspersed with grass and brush covered uplands, saline flats, marshes and shallow bays. Historically, the Bahia Grande area was rich in biological resources and contained important waterfowl habitat, especially for wintering waterfowl. Bahia Grande was also an important estuarine nursery area, contributing to a productive sport and commercial fishery. A small island within the bay provided nesting habitat for more than 10,000 terns, gulls and black skimmers. With the construction of the Brownsville Ship Channel in the 1930's and the placement of dredge spoil on the north side of the channel, the shallow bay and wind tidal flats were isolated from the Laguna Madre. Open exchange of water was effectively blocked. An additional blockage was caused by the construction of State Highway 48 when a road bed was created across a portion of the Bahia Grande. These interruptions of the natural hydrological connection between Bahia Grande and the Laguna Madre caused a decline in biological productivity of the tidal flats and loss of wildlife dependent on this productivity, including a decline in waterfowl numbers. In its historical condition of the 1920's, Bahia Grande must have supported wintering flocks of redheads and other ducks, much as the adjacent Lower Laguna Madre does today. Once converted from a dry basin to one inundated by tidal variations, it is highly probable that flocks of redheads and other waterfowl will once again use the area on a regular basis in the winter months. In addition, floral assemblages were altered. At present, Bahia Grande is barren and dry most of the year with only portions having ephemeral, moist sediment or standing water conditions. Primary inflows are limited to water captured during precipitation events and occasional storm surges.

Reasons for restoring flow to this system are:

(1) to provide nursery areas and habitat for aquatic organisms such as shrimp, crabs and finfish,

(2) to provide habitat for resident and migratory wildlife such as water birds,

(3) to reduce Bahia Grande as a source of windblown dust, and

(4) to provide increased public recreational areas.

The U.S. Fish and Wildlife Service proposes to re-flood and restore the Bahia Grande through construction of a channel or channels designed to take advantage of the normal tidal regime in the area and permit adequate tidal exchange of salt water to maximize water circulation as well as allow migration of marine organisms into and out of the basin. These actions will significantly increase productivity of this wetland system. Engineering and hydrological studies indicate that under favorable conditions water may inundate approximately 6,500 acres. A topographic survey shows that most of the Bahia Grande basin lies below mean sea level (MSL) and would be inundated with seawater during low tides. Additional acreage would be inundated by high tides, storm surges or periods of high rainfall.

There is much local interest between both private individuals and agencies in the prospect of restoring flow and productivity to Bahia Grande. Support comes from local landowners, officials and residents of nearby communities, and a number of conservation organizations (The Ocean Trust, The Conservation Fund, Natural Resources Conservation Service, Ducks Unlimited, Coastal Conservation Association, National Marine Fisheries Service, National Fisheries Institute and Texas Parks and Wildlife Department). Several organizations have offered financial and technical assistance for the Bahia Grande restoration project.

A hydrological modeling and channel design study has been funded by the National Marine Fisheries Service, and is available on request from the South Texas Refuge Complex. It was produced as a thesis headed by Dr. Billy Edge of the Ocean Engineering Program, Department of Civil Engineering, Texas A&M University. This study details the water circulation and mixing needed in the Bahia Grande to accomplish biological productivity goals and gives recommendations on the technical aspects of channel design needed to accomplish these goals. It was from this thesis, by Dianna L. Van Valkenburg, that channel designs for this project were taken.

The proposed re-flooding and restoration project of Bahia Grande has four different alternatives:

(I) Alternative I: (No Action Alternative) No Flooding,

(II) Alternative II: Flooding from San Martin Lake only (Channel A),

(III) Alternative III: Flooding from Brownsville Ship Channel only (Channel E), and

(IV) Alternative IV: (Preferred Alternative) Flooding from both directions (II and III).

See Figure 1. for a graphical depiction of the approximate locations of these planned channels.

Figure 1. **Overview of the Project Area: Bahia Grande, Laguna Larga, and Little Laguna Madre. Red lines represent refuge boundaries. Yellow, dashed lines represent approximate locations of proposed channels, as discussed in this document. (Photo courtesy of USGS, Digital Orthophoto Quarter Quadrangles (DOQQ's)).**

FINAL DRAFT

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1.1 Purpose and Need

1.1.1 Purpose

The purpose of the proposed action is to reestablish, as much as possible, the natural character and biological functions of the Bahia Grande. Ultimately, implementing the proposed action would allow the Laguna Atascosa National Wildlife Refuge (the Refuge) to further accomplish its migratory bird objectives, while being able to develop, manage, conserve and protect fish and wildlife resources (under the Fish and Wildlife Act of 1956). The original enabling legislation for the Refuge and its current purposes make it clear that refuge objectives include conservation and maintenance of wintering habitat for migratory waterfowl.

1.1.2 Need

Restoration of flow to the Bahia Grande will greatly enhance biological productivity, restore habitat for wintering waterfowl and migratory shorebirds, create additional nursery habitat for finfish and shellfish populations and restore and enhance other native wildlife and plant communities, including seagrass beds and fringing black mangrove stands. This effort represents an opportunity to restore a natural tidal hydrological pattern in the Bahia Grande, with the goal of achieving a biodiversity level currently present at nearby San Martin Lake. As well as providing needed habitat for waterfowl, shorebirds, wading birds and other wildlife, this restoration could open up new recreational fishing opportunities and contribute to the commercial shellfish and finfish industries. In addition, a blowing sediment problem, which is affecting air quality in nearby communities, will be greatly reduced (Photo A, Figure 2).

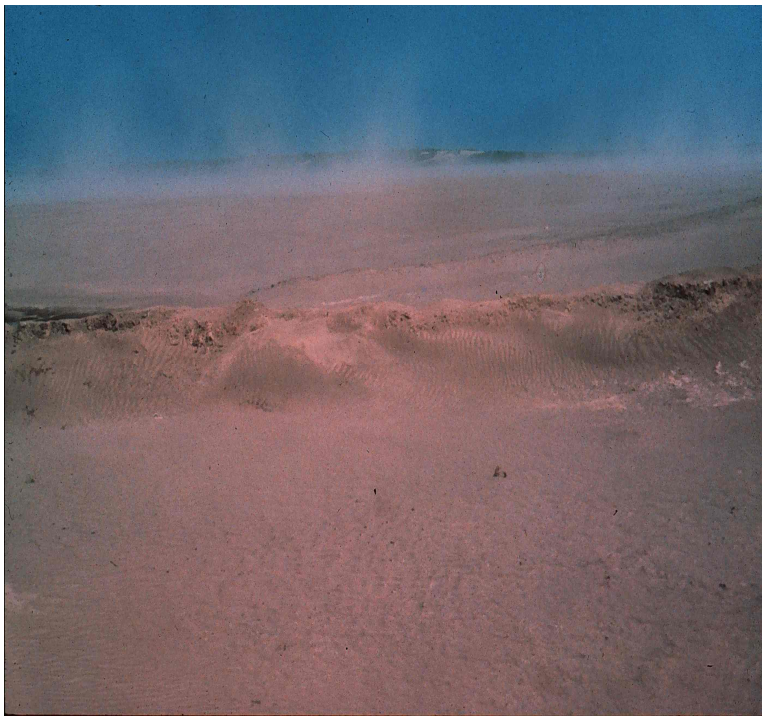

Figure 2. **Windblown dust from Bahia Grande threatens power line transformers, various mechanical devices, and human health. (Photo by Larry Ditto, USFWS)**

San Martin Lake is a presently an active estuary, connected to the Brownsville Ship Channel. The lower third of this estuary is on the Bahia Grande Unit. Lined with black mangroves, and wind tidal flats, San Martin Lake is habitat for cormorants, pelicans, night-herons, herons, egrets, spoonbills, ducks, gulls, terns, and various passerine species. It receives copious freshwater flows from its upper end where several major drainage ditches from Brownsville converge. Because of these drainage ditches' effects, San Martin is often much less salty than the Lower Laguna Madre and Brownsville Ship Channel.

Two documents in Appendix C cite the substantial need for flooding Bahia Grande, Laguna Larga, and Little Laguna Madre, all on refuge lands, to curtail the blowing dust problem. One is a newspaper article from 1945, illustrating the longevity of this dust problem. The other is a letter from the Superintendent of Schools in Port Isabel, listing the problems associated with the blowing dust, including mechanical failure, landscape destruction, and human health threats. While this is not a mandated responsibility of the U.S. Fish and Wildlife Service (the Service), this is an exceptional case, and the alleviation of blowing dust for communities and schools around the refuge is paramount in importance, along with re-creation of wetland habitats for invertebrates, fish, migratory birds, and other wildlife.

There are many positive, beneficial effects that will occur as a result of introducing the historical tidal flow to Bahia Grande, as opposed to the occasional rainwater pool that now occurs therein. The estuarine nature of the restored Bahia Grande will allow shrimp, crabs, finfish, mangroves, and other animals and plants to reenter the basin for purposes of growth and reproduction. Even intermittent dust storms, originating in Bahia Grande, Laguna Larga, or the Little Laguna Madre, will be a past memory and nothing more. Finally, with cessation of the blowing, salty dust, vegetation on the surrounding lomas should be healthier with higher rates of reproduction, resulting ultimately in denser covers of native brush and grasses to benefit, endangered cats, peripheral birds, and other species.

Figure 3. **"From Clouds of Dust to Schools of Fish" (David R. Blankinship, USFWS) – the change being sought by U.S. Fish and Wildlife Service at the Bahia Grande site in Cameron County. (Photo by Steve Labuda, USFWS)**

1.2 Proposed Action

The Service proposes to restore tidal flow to the Bahia Grande, a portion of the Bahia Grande Unit of the Laguna Atascosa National Wildlife Refuge.

This proposed action has resulted from interest and partnerships between the Service and The Conservation Fund, Natural Resources Conservation Service, Ducks Unlimited, Coastal Conservation Association, National Marine Fisheries Service, National Fisheries Institute, Texas Parks and Wildlife Department, and representatives of the shrimping industry and local communities.

Letters of support for this project have been received and references are included in Appendix B. This includes such letters, not only from the entities listed above, but from the adjacent private landowners as well.

1.3 Decisions Needed

The Regional Director, Fish and Wildlife Service, Region 2, will use the final environmental assessment (EA) to make two decisions. The first decision is selecting the alternative to implement. The second decision, required by the National Environmental Policy Act (NEPA), is to determine if the selected alternative will or will not have significant impact on the quality of people's lives or the natural environment. If it is determined that the selected alternative will have significant negative impacts on the human and natural environment, the Service must prepare an environmental impact statement of the proposed action. If not, the Regional Director will sign a finding of No Significant Impact (FONSI), after which the Service can begin the selected alternative as funding is available.

2.0 Description of Alternatives

The proposed re-flooding and restoration project of Bahia Grande has four different alternatives:

(I) Alternative I: (No Action Alternative) No Flooding,

(II) Alternative II: Flooding from San Martin Lake only (Channel A),

(III) Alternative III: Flooding from Brownsville Ship Channel only (Channel E), and

(IV) Alternative IV: (Preferred Alternative) Flooding from both directions (II and III).

2.1 Alternative I: (No Action Alternative) No Flooding

This alternative continues the status quo. No effort to flood will take place and the Bahia Grande will remain an ephemeral wetland, only partially filling with water during extreme rainfall events or tropical storm surges and allowing restricted water access via the current small, deteriorated culverts in place under State Highway 48. At present, according to Dr. Dolores Munoz, Superintendent of Port Isabel Independent School District (Port Isabel ISD), damages to mechanical equipment, amortized over time, amount to an estimated $100,000.00 per year; to landscape and maintain grounds, an estimated $35,000.00 per year; and to human health costs, an estimated $1,500,000.00 per year. This does not include estimates for lost income through fines or lowered air quality in the local area. Land use issues will remain essentially unchanged, except for closer oversight by the Refuge.

Wildlife and fisheries would remain unaffected under this alternative. The basins would remain dry, except for occasional flooding from rainfall. Fisheries resources would be as they are now, minimal to non-existent. Wildlife resources would continue to suffer loss of habitat, from the blowing, salty dust, which kills vegetation on upland sites, and basin rims.

2.2 Alternative II: Flooding from San Martin Lake only (Channel A)

Under this alternative, water will be diverted from San Martin Lake and pass through a constructed channel to inundate Bahia Grande. The size and orientation of the channel will determine the volume and rate of water exchange between the two sites. Estimates from the Van Valkenburg thesis configure the channel at 8,255 feet long, by 50 feet wide, by 4 feet deep (minus 4 feet below mean sea level (MSL)). The engineering drawings of this channel in Appendix D were provided by Richard Bettge of the Natural Resources Conservation Service. Land use issues will remain essentially unchanged, except for closer oversight by the refuge.

The proposed flooding of Bahia Grande, Laguna Larga, and Little Laguna Madre with tidal water will have a positive, beneficial socioeconomic impact on surrounding communities of people. Land developers will build houses on the northern bluffs, along State Highway 100, overlooking the basins. Already (because of recent heavy rainfall that flooded the basin), people are catching crabs along State Highway 48 where the single culvert allows water to flow in and out of Bahia Grande at the present time. Fishing activity, bird watching, and other compatible public uses will have significant beneficial effects in the socioeconomic arena of the local populace.

Wildlife and fisheries would be beneficially affected under this alternative. The basins would be permanently flooded with tidal waters, although mixing and aeration of the water would be minimal. Fishery resources would increase, with many saltwater species, both vertebrate and invertebrate, moving into the Bahia Grande system. Wildlife resources would no longer suffer loss of habitat, from the blowing, salty dust, which kills vegetation on upland sites, and basin

rims. The resultant flush of vegetation would encourage colonization and survival of more and different wildlife species, both on the lomas and on the basins' rims.

2.3 Alternative III: Flooding from Brownsville Ship Channel only (Channel E)

Under this alternative, water will be diverted from the Brownsville Ship Channel, pass through a relatively straight constructed channel and enter under a bridge over State Highway 48 to inundate Bahia Grande. Cooperation must be obtained from the Port of Brownsville as the owners of the channel site. Close coordination is also needed with the Texas Department of Transportation (TXDOT). The size and orientation of the channel will determine the volume and rate of water exchange between the two sites. Estimates from the Van Valkenburg thesis configure the channel at 2,400 feet long, by 200 feet wide, by 9 feet deep (minus 9 feet MSL). The engineering drawings of this channel in Appendix D were provided by Richard Bettge of the Natural Resources Conservation Service. Land use issues will remain essentially unchanged, except for closer oversight by the refuge.

The proposed flooding of Bahia Grande, Laguna Larga, and Little Laguna Madre with tidal water will have a positive, beneficial socioeconomic impact on surrounding communities of people. Land developers will build houses on the northern bluffs, along State Highway 100, overlooking the basins. Already (because of recent heavy rainfall that flooded the basin), people are catching crabs along State Highway 48 where the single culvert allows water to flow in and out of Bahia Grande at the present time. Fishing activity, bird watching, and other compatible public uses will have significant beneficial effects in the socioeconomic arena of the local populace.

Wildlife and fisheries would be beneficially affected under this alternative. The basins would be permanently flooded with tidal waters. Fishery resources would increase and new marine species would colonize the Bahia Grande. Mixing of waters would be even greater than in Alternative II, and this should result in increased survival of seagrasses, mangroves, crustaceans, fish, and other marine species. Wildlife resources would no longer suffer loss of habitat, from the blowing, salty dust, which kills vegetation on upland sites and the basins' rims. Instead, vegetation would flourish, and dependent wildlife species would increase.

2.4 Alternative IV: (Preferred Alternative) Flooding from both directions (II and III)

Under this alternative, two channels (Alternatives II and III) will be constructed. The level of circulation desired in the Bahia Grande will necessitate implementation of both channels. These will be used simultaneously or individually to provide adequate tidal circulation. Hydrological, topographic and engineering studies provide recommendations on channel dimensions necessary for adequate tidal circulation in Bahia Grande and assist restoration planning. The final results of this study, in thesis format, are included in Appendix C, and are summarized in the following

section, Study Results. Land use issues will remain essentially unchanged, except for closer oversight by the refuge.

The proposed flooding of Bahia Grande, Laguna Larga, and Little Laguna Madre with tidal water will have a positive, beneficial socioeconomic impact on surrounding communities of people. Land developers will build houses on the northern bluffs, along State Highway 100, overlooking the basins. Already (because of recent heavy rainfall that flooded the basin), people are catching crabs along State Highway 48 where the single culvert allows water to flow in and out of Bahia Grande at the present time. Fishing activity, bird watching, and other compatible public uses will have significant beneficial effects in the socioeconomic arena of the local populace.

Wildlife and fisheries would be beneficially affected under this alternative. The basins would be permanently flooded with tidal waters. Fishery resources would increase and new marine species would colonize the Bahia Grande. Mixing of waters would be even greater than in Alternative II or III, individually, and this should result in increased survival of seagrasses, mangroves, crustaceans, fish, and other marine species. Wildlife resources would no longer suffer loss of habitat, from the blowing, salty dust, which kills vegetation on upland sites and the basins' rims. Instead, vegetation would flourish, and dependent wildlife species would increase.

2.5.1 Study Results

A series of channel depths and widths were modeled for each of the channel sites proposed. In summary, a combination of (I) Channel A, between San Martin Lake and Bahia Grande, 8,255 feet long, 50 feet wide and 4 feet below MSL, coupled with (II) Channel E, between the Brownsville Ship Channel and Bahia Grande, 2,400 feet long, 200 feet wide and 9 feet below MSL, is the recommended size of inlet channels (Figure 4). Working together, these two channels provide maximum mixing and exchange of waters in the basins (Van Valkenburg, Dianna L., 2002, ME Thesis, Ocean Engineering Program, Texas A&M Univ.)

Channel	**Channel Length (ft)**	**Channel Width (ft) at bottom**	**Channel Depth (ft, depth below mean sea level)**	**Channel Cross Sectional Area (ft^2)**	**Volumetric Flow (ft^3/12.5 hours)**
A	8,255	50	- 4	200	2,946,489
E	2,400	200	- 9	1800	80,892,032
Total				2000	83,839,032

Figure 4. Preferred Alternative of Channels A and E, used to flood Bahia Grande, Laguna Larga, and Little Laguna Madre, with maximum effects (Van Valkenburg, D. L., 2002, TAMU)

A series of models was used to test the efficacy of different channel configurations. The results were that Channel E, running from the Brownsville Ship Channel to Bahia Grande is about twice as effective as Channel A, running from San Martin Lake to Bahia Grande (Figure 5).

Channel	**Channel Length (ft)**	**Channel Width (ft)** at bottom	**Channel Depth (ft, depth below mean sea level)**	**Channel Cross Section (ft^2)**	**Volumetric Flow (ft^3/12.5 hours)**
A	8,400	200	- 4	800	16,953,344
E	4,000	200	- 4	800	38,397,248

Figure 5. Relative efficiency of an 8,400-ft. Channel A and a 4,000-ft. Channel E, based on lunar tides only. (Van Valkenburg, D. L., 2002, TAMU)

This difference in efficiency is directly related to the length of the channels in question. Channel A is estimated to be 8,400 feet, and Channel E is estimated to be 4,000 feet. The table above (Figure 5) and these length estimates are illustrating the efficiency of channels based on length alone. Additional work on the modeling project includes consideration of wind effects. The strong southeast trade winds and equally strong winter storm fronts ("blue norther") have effects equal to or greater than that of the lunar tides used to model the data presented in this EA and in the thesis in the appendix.

The winter and early spring of 2002/2003 allowed a unique opportunity to study the effects of wind tides on the Bahia Grande. Two tropical depressions in early November dumped 22+ inches of rainfall in a one week period on eastern Cameron County. This rainfall rapidly flooded the dry Bahia Grande basin. From January through March 2003, records were made of the rise and fall of the water column along State Highway 48, using two standard water measurement gauges inserted in Bahia Grande and visible from State Highway 48. The results of this study are summarized in Figure 7 below.

Water Gauge Site	**Calm Wind Conditions**	**Strong SE Winds**	**Strong NW winds**
#1, Port Isabel	0.5125	0.18	1.106
#2, Yellow Gate	0.4612	0.18	1.029
Average	0.4868	0.18	1.068

Figure 7. Wind tide measurements in Bahia Grande during the early spring, January through March 2003. Figures represent difference in water column height in feet.

As can be seen in the above table (Figure 7), the average difference between calm conditions and gusty southeast winds was 3.7 inches. The difference between calm conditions and the gusty northwest winds was 6.97 inches. This results in maximum difference of 10.66 inches between "low tide" with a strong southeast wind and "high tide" with a "blue norther" blowing. These figures represent water column depth difference based on wind effects only. This will have an effect in addition to the lunar tidal data compiled in the Van Valkenburg thesis.

A third unnamed channel, into Laguna Larga, will bring rain waters from the north side of State Highway 100, under the highway, and down a constructed ditch, through an old resaca bed, to Laguna Larga. This channel is being constructed by the Natural Resources Conservation Service, in partial fulfillment of requirements for their assistance in helping the Service acquire the lands on which Bahia Grande is located. The objective of this third channel will be to bring fresh rainwater from the areas around State Highway 100 and Laguna Vista into Laguna Larga, making it a basin with more fresh water than will be present in Bahia Grande and Little Laguna Madre. A topographic map of the project area and sectional views for all channels, (Alternatives II and III), are found in Appendix D. These engineering drawings were developed by the Natural Resources Conservation Service, U.S. Department of Agriculture (USDA).

The rainwater that is now occasionally trapped in Bahia Grande, Laguna Larga and Little Laguna Madre, is not really freshwater. Salinity readings taken in mid-November 2002, after the basins were filled with rainwater runoff associated with two early November tropical depressions, were in the range of 21 ppm to 28 ppm, only about 5 ppm lower than ocean water. This is too salty for cattails and other freshwater plants to survive, but is appropriate for black mangroves and other marine/estuarine plants. Consequently, the provision of permanent tidal waters will not negatively impact any species that may depend on pools of fresh rainwater, since the fresh water that enters the basins now mixes with the salt in the bottom soils, and produces a saltwater mix that is only slightly fresher than ocean water.

A monitoring study has already been funded to the University of Texas-Pan American, through the Marine Research Laboratory. Primary researchers for this study, which is intended to track colonization of the Bahia Grande, Laguna Larga, and Little Laguna Madre basins by marine species, plant and animal, are Hudson Deyoe and Don Hockaday (pers.comm.) Additional funds for evaluation are now available through the Environmental Protection Agency (EPA).

3.0 AFFECTED ENVIRONMENT

3.1 Climate

The Bahia Grande area, located along the Gulf Coast of Texas in the Lower Rio Grande Valley, lies approximately 27 degrees north of the equator and receives an average annual rainfall of 26 inches (50-year average). The climate is both semi-arid and subtropical. Diurnal onshore and nocturnal offshore breezes moderate the thermal highs and lows along the coast. Prevailing

winds, from the southeast off the Gulf of Mexico bring high humidity most of the year. Seasonal temperature variations range from a mean of 62^0 F in the winter to 84^0 F in the summer. Freezing temperatures occur once every four years on the average. Tropical storms and hurricanes periodically strike the area during the summer and fall months. Drought conditions, some of which extend over several years, also occur periodically.

3.2 Air Quality

The Bahia Grande area is within Region 15 of the Texas Commission on Environmental Quality (TCEQ). According to information released by the TCEQ, the area is in attainment of unclassifiable for all National Ambient Air Quality Standards (NAAQS). Blowing dust accounts for most of the particulate matter in the region's air. This information was obtained from personal communication with the TCEQ office in Harlingen, Texas, (956) 425-6010.

3.3 Geology and Soils

The Gulf Coast Plain is geologically of recent origin. The area is typified by sediments deposited during Pleistocene interglacial periods. Most of the sediments were derived from deltaic or fluvial deposits of the ancestral Nueces and Rio Grande Rivers. Large portions were subsequently covered by wind-deposited silts and sands. These sediments continue to undergo wind transport and form extensive dune fields on the barrier islands and clay lomas (brushy dunes) in the Rio Grande delta. Wetland soils in the area are scattered and highly variable, usually with little peat and high sand content. This information was obtained from "Soil Survey of Cameron County, Texas. United States Department of Agriculture. Soil Conservation Service. Texas Agricultural Experiment Station. 1977."

3.4 Water Resources

Several types of wetland habitat are found in the Bahia Grande area including inland ponds and impoundments, resacas (old oxbow river channels), estuaries and tidal flats. San Martin Lake contains permanent water even in drought years. Other surface waters are seasonal in nature. The Bahia Grande is a tidal bay that was disconnected from the Gulf of Mexico by the construction of the Brownsville Ship Channel in the 1930's.

According to the Texas Parks and Wildlife Department in Brownsville, the Lower Laguna Madre area has tremendous importance as a finfish and shellfish nursery area on which a major commercial fishery and a lucrative recreational fishery are dependent. The Lower Laguna Madre supports the largest shrimping fleet in Texas.

3.5 Biological Resources

3.5.1 Wildlife

The Bahia Grande Unit of the Laguna Atascosa National Wildlife Refuge is located within the Tamaulipan Biotic Province and, in conjunction with surrounding natural lands, is regarded as an important reservoir of natural biological diversity. Limited wildlife surveys on the Unit have recorded several of the Valley's "million dollar" birds, the plain chachalaca, groove-billed ani, great kiskadee, and green jay. Other wildlife of interest encountered on the Unit are the Texas horned lizard, Rio Grande lesser siren, bobcat, ocelot, javelina, and nilgai. Just since November of 2002, anglers have been catching blue crabs (*Callinectes sapidus*) at the single culvert that allows water to flow into and out of Bahia Grande, under State Highway 48. It is certain that with permanent tidal flooding of the basin, marine life like crabs, shellfish, various other invertebrates, and finfish will colonize the restored bay. The uplands likewise should support more species than are presently there, and denser populations of native wildlife are an expected result. The Laguna Atascosa National Wildlife Refuge has documented more than 400 species of birds, one of the highest diversities on National Wildlife Refuges in the nation. The Rio Grande lesser siren, black-spotted newt, green jay, brown jay, tropical parula, Texas ayenia, Coues rice rat, ocelot, and jaguarundi occur only in the Tamaulipan Biotic province. (Refuge Checklists.)

The piping plover, a federally listed threatened species, is particularly dependent on both sides of the Lower Laguna Madre for its winter habitat, spending more than nine months a year in the area. Depending on wind direction and tidal influence, this species may need algal flats on the north end of South Padre Island and wind tidal flats on the mainland, including the Bahia Grande area. It has been estimated that 10 to 20 percent of the world's population of piping plovers use the Lower Laguna Madre area. In addition, the snowy plover, a species of concern, is both a summer nesting and winter species. (Refuge files, a thesis by Mike and Rose Farmer, 1996) This species' habitat will be enhanced by the proposed flooding of Bahia Grande and the ancillary wetlands.

Sand/mud/algal flat environments are important feeding sites for a variety of wildlife species including the piping plover, which is listed as a threatened species by the federal government. These flats provide a rich source of aquatic and surface invertebrates such as worms, flies, small crustaceans (including crabs and shrimp) and molluscs (including clams and snails), which are essential food for shorebirds and wading birds as well as other wildlife. These species will also benefit from enhanced habitat conditions as a result of flooding Bahia Grande and the ancillary wetlands.

The Lower Laguna Madre area contains important habitat for migratory and resident waterfowl and shorebirds and as well as wading birds. It is an important migration corridor for other birds such as peregrine falcons, ospreys and swallow-tailed kites and is an important resting and

feeding area for trans-Gulf neotropical migrant bird species. (The Peregrine Fund, Annual Report, 1998.)

The Bahia Grande area supports the federally endangered northern aplomado falcon. Through a reintroduction program headed by The Peregrine Fund, several releases of falcons have occurred in the area. Aplomado falcons have successfully nested nearby. This popular falcon attracts bird watchers from all over the world, and its numbers will assuredly increase as a result of the permanent tidal flooding of Bahia Grande. More shorebirds on the flooded flats, and more passerines on the restored lomas will represent more prey available for these avian predators.

3.5.2. Vegetation

The general area in which the Bahia Grande is located is classified by Blair (1950) as the Tamaulipan Biotic Province of Texas. The boundaries of the Tamaulipan Biotic Province approximate those of South Texas Plain vegetation, also known as the Rio Grande Plain, which lies south of San Antonio between the Rio Grande and the Gulf Coast.

By examining San Martin Lake, immediately south of Bahia Grande, one can envision the changes that will probably occur in the dry basin when it is flooded with tidal waters. San Martin Lake is ringed with black mangroves and open shorelines, providing habitat for myriad cormorants (both neotropic and double-crested), white and brown pelicans, terns, gulls, night-herons (black-crowned and yellow-crowned), herons, egrets, ducks, American pipits, eastern and western meadowlarks, horned larks, and others.

The topographically diverse nature of Bahia Grande, with basins and lomas, prairies and woodlands, will contribute to a diverse assemblage of wildlife species. Different species inhabit different habitats and there will be a variety of different habitats available when the permanent tidal flooding is realized. By putting permanent water on the basins, even the highest lomas will benefit. Windblown, salty dust will be a thing of the past, and as future rains leach the existing salt out of the topsoil layers, plant life will flourish, and the dependent wildlife species will not be far behind.

3.6 Cultural Resources

An important cultural resource is an abandoned railroad bed that bisects the Bahia Grande. The railroad bed consists of local fill and windblown sand/clay drifts around approximately 2 miles of degraded cypress pilings on which a narrow-gauge railroad trestle was historically supported. From information provided by the Port Isabel Museum, it has been determined that this railroad was originally constructed in 1865 under command of General Phil Sheridan to move Union troops between Brownsville and Port Isabel. Later, in 1872, Simon Celaya converted the army railroad to a “42-inch gauge” railroad, and named it the Rio Grande Railroad. This railroad ran a total of 24 miles between Brownsville and Port Isabel. Some of the railroad bed is deteriorated

and some pilings are missing; therefore, this resource is no longer intact. A review of this resource was conducted by Service archaeologist David Siegel. No problems were anticipated, as restoring flow to the Bahia Grande would not produce areas of inundation of water depths greater than what occurred historically under natural high tide conditions more than 70 years ago before the Bahia Grande was isolated. It was determined that breaching the railroad bed would not diminish the overall integrity of the property's location, design, setting, materials, or workmanship. The restoration project would replicate historic flooding conditions, would not exceed historical flood levels, and was determined to represent the type of activity that has no potential to cause effects on historical properties present. The freshwater ditch that will bring rainwater into Laguna Larga will cut though the railroad right of way, but only where local fill materials were used to elevate it. No pilings or other structures will be impacted by this freshwater ditch's crossing of the right of way.

Bill Martin of the Texas Historical Commission, Archeology Division, has been contacted and had asked that the Service use an archeologist to examine all of the shoreline areas of Bahia Grande, and the area planned for Channel D, in particular. A high ridge of loma, lying between the Laguna Larga and Little Laguna Madre basins, is a site that has the highest potential to be a pre-Columbian Indian site. The Service contacted the Natural Resources Conservation Service (NRCS), which has a state archeologist in Temple, Texas. The Service requested to have the NRCS archeologist examine the area at the same time he was scheduled to examine another proposed work site that NRCS had designated for channeling water from the north side of State Highway 100 into Laguna Larga. This site visit by Calvin Sanders, NRCS State archeologist, occurred on Tuesday, May 13, 2003. Accompanied by Service personnel, Sonny Perez, Rudy Escamilla, and Stephen E. Labuda, Jr., Mr. Sanders made an inspection of the area, including two, known, minor sites. No artifacts were found, and the preliminary indication is that a negative report will be sent to the State Historical Protection Office (SHPO) by Mr. Sanders.

3.7 Land Use

Grazing is the primary land use on private lands outside of refuge boundaries in the vicinity of the Bahia Grande. Also nearby are the communities of Port Isabel, Laguna Heights, and Laguna Vista. Urbanization is steadily enlarging the boundaries of these communities and many rural properties are being developed as commercial and residential areas. Figure 1. is a map of Bahia Grande and the surrounding area. It shows these various towns, highways, and other landscape features on and around the Bahia Grande Unit.

The Brownsville Port Authority (Brownsville Navigation District, BND) owns the Brownsville Ship Channel that parallels the southern boundary of the Bahia Grande Unit. The Brownsville Ship Channel would be a major source of water inflow into the system should Channel E be constructed between the Brownsville Ship Channel and Bahia Grande. Presently, the Service leases land along the ship channel from the BND as the Lomas Ecological Preserve, a unit of the Lower Rio Grande Valley NWR. This lease was originally negotiated for a period of forty years.

The BND has easements for spoil placement on private lands adjacent to the Brownsville Ship Channel.

There is a limited amount of oil and gas drilling in and near the Bahia Grande Unit. In addition to a lease agreement from the Texas General Land Office, and permit(s) from the U.S. Army Corps of Engineers, potential oil and gas exploration companies are required to obtain a Special Use Permit from the Refuge, the surface owner and land manager, before drilling for oil and gas on the Unit. A Special Use Permit was recently issued authorizing the drilling of an exploratory gas well about three-quarters of a mile north of the proposed location for Channel A.

Land use issues, such as oil and gas exploration and development, will remain essentially unchanged. The Service's Comprehensive Conservation Planning (CCP) process, which provides for significant public input on land and public use issues, is in the early planning stages for the Laguna Atascosa National Wildlife Refuge. When completed, it will include the Bahia Grande Unit.

3.8 Socioeconomic Considerations

This issue includes concerns about individual and local economic endeavors and quality of life resulting from the restoration project.

The Lower Laguna Madre supports the largest shrimping fleet in Texas. The local shrimp fishing industry's harvested shrimp value reaches $50,000,000 a year (Lower Laguna Madre Foundation).

The Lower Laguna Madre Foundation estimates the Lower Laguna Madre is worth more than $400 million to Texas businesses yearly from sport fishing and recreational use.

Tourism and related economic sectors, such as retail trade and lodging, are very important to the local economy. Nature tourism is increasing in popularity and many people are coming to the Lower Rio Grande Valley to see its rich and diverse natural resources, including its wildlife species, many of which are found nowhere else in the country.

The proposed flooding of Bahia Grande, Laguna Larga, and Little Laguna Madre with tidal water will have a positive, beneficial socioeconomic impact on surrounding communities of people. With elimination of the blowing dust from these particular basins, land developers will build houses on the northern bluffs, along State Highway 100, overlooking the basins. Already, people are catching crabs along State Highway 48 where the single culvert allows water to flow in and out of Bahia Grande at the present time. Fishing activity, bird watching, and other compatible public uses will have significant beneficial effects in the socioeconomic arena of the local populace.

3.8.1 Tax Revenues

For fiscal year 2001, the Service paid a Refuge Revenue Sharing amount of $166,210 to Cameron County to help compensate the county for lost property taxes attributable to the Laguna Atascosa National Wildlife Refuge, including the Bahia Grande Unit.

This proposed action would have no effect on these Refuge Revenue Sharing payments to Cameron County.

3.9 Public Use and Recreation

Many Texans believe preserving environmental quality for recreation and nature tourism is an important concern. *Eye on Nature*, a booklet published by Texas Parks and Wildlife Department (Austin, Texas, 1998) reported that by the year 2000, an estimated 18 million Texans will participate in nature tourism, especially birdwatching. Economists generally recognize that income that comes from people from outside of a given area, but spent within that area realizes more positive economic benefits to that area than income generated and spent within that area.

The current direction of public use, recreation, and management of the Bahia Grande Unit of the Laguna Atascosa NWR is guided by the Final Conceptual Management Plan (FCMP), which is included in Appendix D of the Laguna Atascosa National Wildlife Refuge - Proposed Refuge Expansion Plan (Environmental Assessment and Conceptual Management Plan), approved in September 1999. Future direction of public use, recreation, and management of the Unit will be determined during the development and completion of a Comprehensive Conservation Plan (CCP), which is scheduled to be started in fiscal year 2004, for the Laguna Atascosa NWR. The CCP process will include extensive public involvement through public outreach and multiple public meetings at various stages of the process.

The FCMP found six public recreational activities compatible with the purposes of the Bahia Grande Unit: recreational fishing, recreational hunting, wildlife observation, wildlife photography, environmental education, and interpretation. However, the only legal, and compatible, public recreational use that occurred on the Unit prior to acquisition by the Service was bank fishing (for crabs and finfish) along the right-of-way boundary of State Highway 48 at San Martin Lake and the Bahia Grande lake basin (when seasonally flooded). This traditional use will continue to be allowed. Private (not public) hunting leases for deer, waterfowl, dove, and quail occurred on the Unit prior to acquisition by the Service. Public recreational hunting (e.g., white-tailed deer, waterfowl, and feral pig) is not currently allowed; however, it will, along with wildlife observation (e.g., wildlife tour loop, observation platforms), wildlife photography, expanded recreational fishing (e.g., wade fishing), boating access (e.g., canoe, kayak), environmental education, and interpretation (e.g., guided environmental and cultural resource tours) will be evaluated through the CCP process. The final, approved CCP will identify the

scope and intensity of each of these wildlife-dependent public recreational uses on the Bahia Grande Unit.

The only refuge sanctioned public use now occurring on the Bahia Grande Unit includes walk-in bank fishing on San Martin Lake, with access from State Highway 48. As mentioned above, some crabbing by locals also occurs in the vicinity of the single culvert under State Highway 48 that allows water in and out of Bahia Grande.

Fishing and boating occur adjacent to the Bahia Grande in the Lower Laguna Madre, Brownsville Ship Channel and at an access point along State Highway 48. If permanent tidal waters are introduced to Bahia Grande it may be compatible, as mentioned above, to allow non-motorized watercraft such as kayaks and canoes to use the area. Certainly, wading anglers would want to try their luck in the shallow bay. Flounder, redfish, and spotted seatrout are the most avidly sought species in such locations.

Hunting for waterfowl, bobwhite quail, mourning and white-winged doves, nilgai (an exotic antelope), white-tailed deer and wild hogs occur in areas adjacent to the Bahia Grande. While public hunting is not currently allowed on Bahia Grande, it may be possible to provide some high quality hunting for waterfowl, doves and quail. White-tailed deer are not numerous enough at the present time to support such a refuge hunt; however, public hunts may be allowed to help control exotic wild hogs and nilgai, both of which compete directly with native wildlife and destroy habitat.

Some unauthorized public use also occurs. The most common infractions are trespass vehicles, littering, and fishing without a license, particularly in the area along San Martin Lake where walk-in bank fishing is permitted. Some limited poaching of javelina, nilgai, and white-tailed deer occurs along the western section of the Unit where a county road parallels the refuge boundary. Also, cattle trespass occurs at varying degrees; however, Refuge law enforcement actions have greatly reduced, but not eliminated this persistent problem.

3.10 Contaminants and Hazardous Wastes

In 2000, a tank truck on State Highway 48 overturned near San Martin Lake. Its cargo, a chemical called *Furfural*, spilled into the borrow ditches on the sides of State Highway 48, which at the time were filled with water, connected to San Martin Lake. Texas Parks and Wildlife Department took the lead in cleaning up this toxic spill, and minimal loss of wildlife was reported, probably due to the volatile nature of the chemical which did not stay in the water or the environment for more than three or four days. Still, this spill alone gives cause for concern. The Service knows that such accidents may happen again. For this reason, a Spill Contingency Plan is maintained by Laguna Atascosa National Wildlife Refuge, and supplies (oil spill booms, rubber gloves, detergent, etc.) are maintained in refuge storage areas.

4.0 ALTERNATIVES AND ENVIRONMENTAL CONSEQUENCES

4.1 Alternative I - (No Action Alternative) No Tidal Flooding

This alternative continues the status quo. No effort to flood would take place and the Bahia Grande would remain an ephemeral wetland, only partially filling with water during extreme rainfall events or tropical storm surges and by very restricted water access via the current small, deteriorated culverts in place under State Highway 48. Salty dust would continue to blow out of the basin, and into surrounding communities, increasing the incidence and severity of respiratory symptoms, degradation of metal structures (e.g., HVAC units), and causing wildfires through short circuits on power line transformers (two wildfires known in the past five years).

Wildfires have been started by blowing, salty dust affecting power line transformers. The possibility of eventual litigation against the Service as a result of wildfires, property loss, and human health problems remains a distinct possibility.

Various wildlife watering devices, including "guzzlers" and water from oil and gas exploration wells, are used to provide potable water for various wildlife species present. The continued blowing dust will also impact plants growing on upland loma sites around the basins. With reduced cover, low wildlife diversity and numbers will be the norm.

4.1.1 Climate

This alternative would not have an effect on climate.

4.1.2 Air Quality

Under this alternative, air quality would remain unchanged. Blowing dust accounts for most of the particulate matter in the region's air. A traffic hazard will be occasionally present in the form of blowing dust, which reduces visibility, across State Highway 48. As urbanization progresses around the Bahia Grande, it can be expected that more and more people will suffer respiratory problems as a result of the continuing dusty conditions.

4.1.3 Geology and Soils

There would be the continuing effect on soils in the area, because silt and sand would still be wind transported and dust will continue to be a problem. These "blowouts" are created by the wind's scouring action on the bay bottom, digging ever deeper, and deeper. Salty dust blown out covers upland vegetation, killing it and preventing other vegetation from getting established. This results in erosion, possibly affecting even geological formations. The effect on soils and geology of the continuing dry basins is negative, and potentially significant.

4.1.4 Water Resources

The tidal flat area of the Bahia Grande would remain an ephemeral wetland. Only a small portion of this acreage will be covered with water during extreme rainfall events or tropical storm surges.

4.1.5 Biological Resources

Little habitat for wading birds, shorebirds, and threatened species like the piping plover would continue under this alternative. Fishery resources would continue to blossom with tropical rainfall events, and then literally "dry up" as drier months ensue. Furthermore, increased urbanization in the surrounding areas, which will occur whether or not Bahia Grande is flooded, would introduce feral dogs and cats that would have far-reaching effects on native wildlife species. In addition, new drains from urbanized areas might affect the area in ways unknown at this point in time.

4.1.6 Cultural Resources

The refuge would continue protection of cultural resources under this alternative.

4.1.7 Land Use

Land use would continue as at present.

4.1.8 Socioeconomic Resources

The area surrounding the Bahia Grande would continue to follow a trend of increased urbanization. Under this alternative, land values would change only as the local markets are affected by future trends. Market values might increase due to anticipated increased development in areas such as along State Highway 100 and close to towns. There would be no effect on the commercial shellfish and finfish industry. The continued blowing dust may affect some real estate values in certain areas.

4.1.9 Effects on Tax Revenues

There should be no effect.

4.1.10 Public Use and Recreation

Presently there is a good deal of tourism and economic benefit associated with South Padre Island. A good parallel would be to look at the City of Harlingen. Harlingen was the very first city in the Lower Rio Grande Valley (Valley) to sponsor a Birding Festival. In their first year,

1995, the Festival brought in $3.5 million in a five-day period. This was all nature-related tourism, and about 50% of it was directly related to the Valley refuges, particularly Laguna Atascosa NWR. Tours, talks, and help with building and setting up props for a lunch area at the Festival, all helped generate more economic benefit because of the refuge. Unfortunately, the landscape of the Bahia Grande Unit is very xeric and relatively unattractive, and it will stay that way with no admittance of permanent tidal waters into the basins thereon.

Very little to no benefit is associated with Bahia Grande under this alternative. This status quo would not change if the basins are not flooded with permanent tidal waters.

4.1.11 Contaminants and Hazardous Waste

No change in levels of contaminants or hazardous waste is expected.

4.2 Alternative II: Flooding from San Martin Lake only (Channel A)

Under this alternative, water will be diverted from San Martin Lake and pass through a 8,255-foot, constructed channel to inundate Bahia Grande. The size and orientation of the channel will determine the volume and rate of water exchange between the two sites. Hydrological, topographic and engineering studies have been completed and recommendations provided by Texas A&M University's Department of Civil Engineering, School of Ocean Engineering. Channel dimensions necessary for adequate tidal circulation in Bahia Grande also assist restoration planning.

In addition to Channel A itself, a series of three other channels will be dug. These have been designated as Channels B, C, and D as follows:

> Channel B, 60 feet wide, by -2 feet below MSL, and 7,800 feet long, will connect Bahia Grande to Laguna Larga, allowing 1,669 acres of additional flooding in Laguna Larga;
>
> Channel B_2, an alternative route for Channel B, 60 feet wide by -2 feet below MSL, and 3,270 feet long will connect Bahia Grande to Laguna Larga, allowing 1,669 acres of additional flooding in Laguna Larga, if selected for implementation;
>
> Channel C, 60 feet wide, by -2 feet below MSL, and 8,400 feet long, will connect Bahia Grande to Little Laguna Madre, allowing 1,411 acres of additional flooding in Little Laguna Madre; and.
>
> Channel D, 60 feet wide, by -2 feet below MSL, and 5,000 feet long, will connect Laguna Larga to Little Laguna Madre, enhancing circulation of water between these two basins.

A total of about 6,500 acres will be flooded in Bahia Grande under this alternative, 4,000 permanently, and 2,500 tidally. In addition, 1,669 acres in Laguna Larga would be flooded, either by freshwater from the NRCS diversions under State Highway 100, or by saltwater from Bahia Grande. Another 1,411 acres will be inundated in Little Laguna Madre under this alternative. Therefore a total of approximately 9,580 acres will be flooded, either permanently (4,000-plus acres) or periodically by lunar and wind tidal effects (2,500-plus acres). Appendix D provides drawings of various channels, both cross-sectional and longitudinal. There is also a topographic view of the entire project.

Water depths will be very shallow. Average depth will probably be less than 6 inches due to the vast areas that will be covered by the sheet water flows of wind tides. Some areas will be as deep as 3 to 4 feet below mean sea level. The amount of water introduced by lunar and wind tides under this alternative will be significantly less than that introduced by Alternative II. That is because of the direct alignment of Channel E with the prevailing southeast winds. Channel A in this alternative is not aligned so beneficially, and its greater length, 8,255 linear feet compared to 2,400 linear feet with Channel E, work against effective flooding, as well.

4.2.1 Climate

This alternative would not have a singular effect on climate.

Drought will cause some adverse impacts to some wildlife species and their habitats, although these impacts may be ameliorated by the reduction of blowing dust caused by the filling of the basins.

4.2.2 Air Quality

Under this alternative, air quality would improve. Blowing dust would still account for most of the particulate matter in the region's air, but would be reduced in the Bahia Grande area by restoring a tidal hydrological pattern to flood the dry basin. A traffic hazard may still be occasionally present in the form of blowing dust across State Highway 48, but it would be much reduced. The major source of blowing dust would be eliminated, representing perhaps 60% of the total problem. Additional dust may still come from Long Island, from the sides of the Brownsville Ship Channel, and from U.S. Army Corps of Engineers spoil areas in the vicinity.

4.2.3 Geology and Soils

There would be an effect to geology and soils in the area. Silt and sand would continue to be wind transported but these effects would be reduced in the Bahia Grande area by restoring a tidal hydrological pattern to flood the dry basin. Dust storms that adversely affect Laguna Vista, Laguna Heights, and Port Isabel would be reduced in severity. Positive beneficial effect on loma vegetation has already been addressed. In addition, some of the soils removed in digging

channels, when appropriate, will be used to "patch" eroded gullies and other damage to the existing lomas. This should stabilize the erosion problem, conserve the topsoil, and encourage colonization by various plant species, which will further stabilize the areas.

4.2.4 Water Resources

Restoring tidal hydrological patterns in these waters would greatly increase wildlife and fishery values and provide additional recreational opportunities. The exchange of salt water would contribute to improving water circulation in the Bahia Grande. This alternative alone may not provide enough circulation and water mixing to maintain the system at maximum biological productivity. The channel planned for the connection from San Martin Lake to Bahia Grande will be located close to the mouth of San Martin Lake, and in the vicinity of the Brownsville Ship Channel. This placement will minimize the expected turbidity levels that would result from tidal waters flowing back and forth between the two bodies of water. Turbidity effects should be isolated near the mouth of San Martin Lake, and should not affect the entire lake.

A total of about 6,500 acres will be flooded in Bahia Grande under this alternative, 4,000 permanently, and 2,500 tidally. In addition, 1,669 acres in Laguna Larga would be flooded, either by freshwater from the NRCS diversions around State Highway 100, or by saltwater from Bahia Grande. Another 1,411 acres will be inundated in Little Laguna Madre under this alternative. Therefore a total of approximately 9,580 acres will be flooded, either permanently (4,000-plus acres) or periodically by lunar and wind tidal effects (2,500-plus acres). Appendix D provides drawings of various channels, both cross-sectional and longitudinal. There is also a topographic view of the entire project.

All of this additional water is habitat for shrimp, crabs, other shellfish and invertebrates, and finfish, which in turn provide a rich feeding source for shorebirds, wading birds, and waterfowl.

4.2.5 Biological Resources

Habitat for wading birds, shorebirds, and threatened species like the piping plover would be favorably impacted under this alternative. Migration of marine organisms into and out of the Bahia Grande would be increased. Biological productivity will be significantly increased. In addition to the obvious habitat improvement for shrimp, crabs, shellfish and other invertebrates, and finfish, these species will provide a rich feeding source for shorebirds, wading birds, and waterfowl.

Evaluation of the effects of flooding on marine plant and animal species will be provided by one or more of the regional universities. The University of Texas-Pan American, which has a recognized coastal marine science department, has already proposed and had approved a request for funding to the Department of Housing and Urban Development to implement a study of seagrass colonization, using minority students. Texas A&M-Corpus Christi University has

shown interest in conducting a more thorough study of marine organisms colonization in the restored Bahia Grande estuarine system.

The alleviation of the dust problem and restoration efforts creating an attractive wetland may also increase development and market values for properties near the Bahia Grande. This could have a detrimental effect on biological resources on private lands near the Bahia Grande as rural properties are developed and native habitat for wildlife is destroyed. Species impacted with such an urbanization scenario might include Texas tortoise, Texas horned lizard, plain chachalaca, white-tipped dove, Harris' hawk, ladder-backed woodpecker, green jay, great kiskadee, altamira oriole, olive sparrow, bobcat, ocelot, jaguarundi, javelina, and white-tailed deer.

4.2.6 Cultural Resources

Protection of cultural resources would continue under this alternative.

4.2.7 Land Use

The Bahia Grande would be partially restored to a historical natural condition. Recreational use of the Bahia Grande area may be enhanced under this alternative.

The flooding of Bahia Grande will provide a rich study site for universities. Already the University of Texas Pan-American has submitted a proposal to the National Oceanic and Atmospheric Administration (NOAA) to fund a study of seagrasses colonizing the flooded basins, as well as the potential for introducing black mangroves and seagrasses to the site, (Don Hockaday, pers. comm.) Texas A&M University Kingsville has contacted the Service about doing studies of changes in the upland habitats as a result of flooding Bahia Grande, looking at the plant and animal communities, to assess the changes that occur therein (Bill Kuvlesky, pers. comm.). Texas A&M University-Corpus Christi is preparing a funding proposal to assess the complex issue of marine organism colonization, including both plant and animal species (Wes Tunnel and Liz Smith, pers.comm.).

The Service has an interest in encouraging more northern aplomado falcons on the site, through improvement of the habitat, and would also support the natural proliferation of plant life, re-vegetation of denuded loma sites, and stabilization of all wildlife populations native to the site.

4.2.8 Socioeconomic Resources

The area surrounding the Bahia Grande would continue to follow a trend of increased urbanization. Under this alternative, land values would change only as the local markets are affected by future trends. Market values might increase due to anticipated increased development in areas such as along State Highway 100 and close to towns. Alleviation of the

dust problem may also increase development and market value for properties near the Bahia Grande.

Nature tourism and other recreational activities will increase under this alternative due to the increase in wildlife resources. This is likely to have a positive impact on the local economy (Pete Moore, South Padre Island Development Council, pers. comm., and Patrick Marchan, Port Isabel Mayor, pers. comm.).

In addition, commercial and recreational fisheries will be enhanced by restoration of estuarine nursery habitat for shellfish and finfish.

4.2.9 Effects on Tax Revenues

There should be no effect.

4.2.10 Public Use and Recreation

Opportunities for wildlife-oriented recreation, including the "Big Six" priority public uses on national wildlife refuges: hunting, fishing, wildlife observation, photography, environmental education, and interpretation, under this alternative will be explored as part of the Comprehensive Conservation Planning initiative.

4.2.11 Contaminants and Hazardous Waste

No change in levels of contaminants or hazardous waste is expected under this alternative. However, because of the connection to San Martin Lake, there would be potential for the introduction of toxic chemicals into the Bahia Grande due to a spill.

4.3 Alternative III: Flooding from Brownsville Ship Channel only

Under this alternative water will be diverted from the Brownsville Ship Channel, pass through a relatively straight 2,400 feet long by 200 feet wide by 9 feet below MSL, constructed channel and enter under a bridge at State Highway 48 to inundate Bahia Grande. Cooperation must be obtained from the Port of Brownsville as the owners of the channel site. Close coordination is also needed with the Texas Department of Transportation (TXDOT). The size and orientation of the channel will determine the volume and rate of water exchange between the two sites. Hydrological, topographic and engineering studies have been initiated to provide recommendations on channel dimensions necessary for adequate tidal circulation in Bahia Grande and to assist restoration planning. An advantage of this channel is that prevailing winds from the southeast can facilitate maximum inundation of the basin by pushing tidal waters.

In addition to Channel E itself, a series of three other channels will be dug. These have been designated as Channels B, C, and D:

> Channel B, 60 feet wide, by 2 feet below MSL, and 7,800 feet long, will connect Bahia Grande to Laguna Larga, allowing 1,669 acres of additional flooding in Laguna Larga;
>
> Channel B_2, an alternative route for Channel B, 60 feet wide by -2 feet below MSL, and 3,270 feet long will connect Bahia Grande to Laguna Larga, allowing 1,669 acres of additional flooding in Laguna Larga, if selected for implementation;
>
> Channel C, 60 feet wide, by -2 feet below MSL, and 8,400 feet long, will connect Bahia Grande to Little Laguna Madre, allowing 1,411 acres of additional flooding in Little Laguna Madre; and
>
> Channel D, 60 feet wide, by -2 feet below MSL, and 5,000 feet long, will connect Laguna Larga to Little Laguna Madre, enhancing circulation of water between these two basins.

A total of about 6,500 acres will be flooded in Bahia Grande under this alternative, 4,000 permanently, and 2,500 tidally. In addition, 1,669 acres in Laguna Larga would be flooded, either by freshwater from the NRCS diversions under State Highway 100, or by saltwater from Bahia Grande. Another 1,411 acres will be inundated in Little Laguna Madre under this alternative. Therefore a total of approximately 9,580 acres will be flooded, either permanently (4,000-plus acres) or periodically by lunar and wind tidal effects (2,500-plus acres). Appendix D contains drawings of these channels, both cross-sectional and longitudinal. There is also a topographic view of the entire project.

Water depths will be very shallow. Average depth will probably be less than 6 inches due to the vast areas that will be covered by the sheet water flows of wind tides. Some areas will be as deep as 3 to 4 feet below mean sea level. The amount of water introduced by lunar and wind tides under this alternative will be significantly greater than that introduced by either Alternative I or IV. That is because of the direct alignment of Channel E with the prevailing southeast winds. Channel A in this alternative is not aligned so beneficially, and its greater length, 8,255 linear feet compared to 2,400 linear feet with Channel E, work against efficient flooding, as well.

TXDOT is presently reviewing the need to widen Texas 48 to a four-lane expressway, and has separated out the bridge required for Channel E, to “put it on the fast track”. Recent estimates given in meetings with the Cameron County Judge have the estimates for this bridge being let by December 2003, contractor selection by April 2004, and completion of the project by December 2004.

4.3.1 Climate

This alternative would not have a singular effect on climate.

Drought will cause some adverse impacts to some wildlife species and their habitats, although these impacts may be ameliorated by the reduction of blowing dust caused by the filling of the basins.

4.3.2 Air Quality

Under this alternative, air quality would improve. Blowing dust would still account for most of the particulate matter in the region's air, but it would be reduced in the Bahia Grande area by restoring a tidal hydrological pattern to flood the dry basin. A traffic hazard may still be occasionally present in the form of blowing dust across State Highway 48 but would be much reduced. The major source of blowing dust would be eliminated, representing perhaps 60% of the total problem. Additional dust will still come from Long Island, from the sides of the Brownsville Ship Channel, and from U. S. Army Corps of Engineers spoil areas in the vicinity.

4.3.3 Geology and Soils

There would be an effect to geology and soils in the area. Silt and sand would continue to be wind transported, but these effects would be reduced in the Bahia Grande area by restoring a tidal hydrological pattern to flood the dry basin. Dust storms that adversely affect Laguna Vista, Laguna Heights, and Port Isabel would be reduced in severity. Positive beneficial effect on loma vegetation has already been addressed. In addition, some of the soils removed in digging channels, when appropriate, will be used to "patch" eroded gullies and other damage to the existing lomas. This should stabilize the erosion problem, conserve the topsoil, and encourage colonization by various plant species, which will further stabilize the areas.

4.3.4 Water Resources

Restoring tidal hydrological patterns in these waters would greatly increase wildlife and fishery resources, and may provide additional recreational opportunities. The exchange of salt water would contribute to improving water circulation in the Bahia Grande. This alternative alone may not provide enough circulation and water mixing to maintain the system at maximum biological productivity, but it will be more efficient than Channel A alone, Alternative II.

A total of about 6,500 acres will be flooded in Bahia Grande under this alternative, 4,000 permanently, and 2,500 tidally. In addition, 1,669 acres in Laguna Larga would be flooded, either by freshwater from the NRCS diversions under State Highway 100, or by saltwater from Bahia Grande. Another 1,411 acres will be inundated in Little Laguna Madre under this alternative. Therefore a total of approximately 9,580 acres will be flooded, either permanently

(4,000-plus acres) or periodically by lunar and wind tidal effects (2,500-plus acres). Appendix D contains drawings of these channels, both cross-sectional and longitudinal. There is also a topographic view of the entire project.

The effects of this Channel E, while similar to those for Channel A, will, by virtue of its wider and deeper dimensions, and shorter distance overland, provide for faster inflows and exodus of water inside the basin. This may be of special importance during times of heavy rainfall events. Also, because Channel E is more directly aligned with the prevailing southeast winds, wind tidal flooding will be magnified in this alternative.

4.3.5 Biological Resources

Greatly improved habitat for wading birds, shorebirds, and threatened species like the piping plover would be beneficial under this alternative. Migration of marine organisms into and out of the Bahia Grande would be facilitated. Biological productivity will be significantly increased. In addition to the obvious habitat provision for shrimp, crabs, shellfish and other invertebrates, and finfish, these will provide a rich feeding source for shorebirds, wading birds, and waterfowl.

The alleviation of the dust problem and restoration efforts creating an attractive wetland may also increase development and market value for properties near the Bahia Grande. This could have a detrimental effect on biological resources on private lands near the Bahia Grande, as rural properties are developed and native wildlife habitat is destroyed.

Monitoring of marine organisms entering Bahia Grande will be needed to evaluate the survival, reproduction, and use of habitat by marine organisms in the basin. A management plan may be developed through use of a graduate study from one of the regional universities, such as the University of Texas-Pan American, which has a recognized coastal marine science department.

As mentioned under the previous section for Alternative II, alleviation of the dust problem and restoration efforts creating an attractive wetland may also increase development and market value for properties near the Bahia Grande. This could have a detrimental effect on biological resources on private lands near the Bahia Grande as rural properties are developed and native habitat for wildlife is destroyed. Species impacted with such an urbanization scenario might include Texas tortoise, Texas horned lizard, plain chachalaca, white-tipped dove, Harris' hawk, ladder-backed woodpecker, green jay, great kiskadee, altamira oriole, olive sparrow, bobcat, ocelot, jaguarundi, javelina, and white-tailed deer.

On the refuge, marine organisms, fish, crabs, shellfish and other invertebrates, finfish, shorebirds, herons and egrets, ospreys, raccoons, coyotes, and other species, which all benefit from shallow flooding in coastal wetlands, will benefit. Other, upland species, which may not have as direct a relationship with the flooded basins, such as plain chachalaca, great kiskadee,

green jay, Harris' hawk, and others, will benefit as their upland habitats are improved by the reduction of blowing salty dust, and the leaching out of salts by future rainfall events.

The flooding of Bahia Grande will provide a rich study site for universities. Already the University of Texas Pan-American has submitted a proposal to the National Oceanic and Atmospheric Administration (NOAA) to fund a study of seagrasses colonizing the flooded basins, as well as the potential for introducing black mangroves and seagrasses to the site, (Don Hockaday, pers. comm.). Texas A&M University Kingsville has contacted the Service about doing studies of changes in the upland habitats as a result of flooding Bahia Grande, looking at the plant and animal communities, to assess the changes that occur therein (Bill Kuvlesky, pers. comm.). Texas A&M University-Corpus Christi is preparing a funding proposal to assess the complex issue of marine organism colonization, including both plant and animal species (Wes Tunnel and Liz Smith, pers.comm.).

In summary, flooding basins may have a negative impact on wildlife off the refuge, due to urbanization and land clearing. In contrast, flooding the basins will have a beneficial impact on wildlife on the refuge, through habitat improvement associated with the reduction of blowing dust.

4.3.6 Cultural Resources

Protection of cultural resources would continue.

4.3.7 Land Use

The Bahia Grande would be partially restored to a historical natural condition. Recreational use of the Bahia Grande area may be enhanced under this alternative.

The flooding of Bahia Grande will provide a rich study site for universities. Already the University of Texas Pan-American has submitted a proposal to the National Oceanic and Atmospheric Administration (NOAA) to fund a study of seagrasses colonizing the flooded basins, as well as the potential for introducing black mangroves and seagrasses to the site, (Don Hockaday, pers. comm.). Texas A&M University-Kingsville has contacted the Service about doing studies of changes in the upland habitats as a result of flooding Bahia Grande, looking at the plant and animal communities, to assess the changes that occur therein (Bill Kuvlesky, pers. comm.). Texas A&M University-Corpus Christi is preparing a funding proposal to assess the complex issue of marine organism colonization, including both plant and animal species (Wes Tunnel and Liz Smith, pers.comm.).

An EPA grant is available at present, for use in monitoring the biological effects of flooding.

The Service has an interest in encouraging more northern aplomado falcons on the site, through improvement of the habitat, and would also support the natural proliferation of plant life, re-vegetation of denuded loma sites, and stabilization of all wildlife populations native to the site.

4.3.8 Socioeconomic Resources

The area surrounding the Bahia Grande would continue to follow a trend of increased urbanization. Under this alternative, land values would change only as the local markets are affected by future trends. Market values might increase due to anticipated increased development in areas such as along State Highway 100 and close to towns. Alleviation of the dust problem may also increase development and market value for properties near the Bahia Grande. Also, and related to the urbanization problem, but in a positive sense, nature tourism and other recreational activities may increase under this alternative due to the increase in wildlife resources, commensurate with the increased human population. This is likely to have a positive impact the local economy (Pete Moore, South Padre Island Development Council, pers. comm., and Patrick Marchan, Port Isabel Mayor, pers. comm.).

In addition, commercial and recreational fisheries will be enhanced by restoration of estuarine nursery habitat for shellfish and finfish.

4.3.8.1 Effects on Tax Revenues

There should be no effect.

4.3.9 Public Use and Recreation

Opportunities for wildlife-oriented recreation under this alternative will be positive for the general public. The restoration of the Bahia Grande will increase wildlife viewing opportunities, such as birdwatching. Additional public uses, including the "Big Six" priority public uses on national wildlife refuges: hunting, fishing, wildlife observation, photography, environmental education, and interpretation, will be explored. The development of the CCP will include several public meetings to allow the public to propose and comment on potential public recreational uses for the Bahia Grande Unit.

4.3.10 Contaminants and Hazardous Waste

No change in levels of contaminants or hazardous waste is expected under this alternative. However, because of the connection to the Brownsville Ship Channel, there would be potential for the introduction of toxic chemicals into the Bahia Grande due to a spill. The refuge maintains a supply of booms, suits, and other gear to be used by the U.S. Coast Guard (lead agency) and other cooperators, in case of a spill. The refuge Spill Contingency Plan will be updated prior to flooding the basins.

4.4 Alternative IV: (Preferred Alternative) Tidal Flooding from both directions (channels A and E)

The level of water circulation desired in the Bahia Grande will necessitate the construction of both channels. These will be used individually, or simultaneously, to provide adequate tidal circulation. Hydrological, topographic and engineering studies have been completed by Texas A&M University's Department of Civil Engineering, Ocean Engineering Branch, to provide recommendations on channel dimensions necessary for adequate tidal circulation in Bahia Grande and to assist restoration planning with Channels A, B, C, D, and E.

This alternative is the Preferred Alternative because it provides the greatest level of natural circulation of waters in Bahia Grande, Laguna Larga, and Little Laguna Madre. With both "feeder channels" in place, an optimum environment for fish, shrimp, and other marine organisms will be in place.

In addition to the "feeder channels", A and E, a series of three other channels will be dug. These have been designated as Channels B, C, and D:

> Channel B, 60 feet wide, by 2 feet below MSL, and 7,800 feet long, will connect Bahia Grande to Laguna Larga, allowing 1,669 acres of additional flooding in Laguna Larga;
>
> Channel B_2, an alternative route for Channel B, 60 feet wide by -2 feet below MSL, and 3,270 feet long will connect Bahia Grande to Laguna Larga, allowing 1,669 acres of additional flooding in Laguna Larga, if selected for implementation;
>
> Channel C, 60 feet wide, by -2 feet below MSL, and 8,400 feet long, will connect Bahia Grande to Little Laguna Madre, allowing 1,411 acres of additional flooding in Little Laguna Madre; and
>
> Channel D, 60 feet wide, by -2 feet below MSL, and 5,000 feet long, will connect Laguna Larga to Little Laguna Madre, enhancing circulation of water between these two basins.

A total of about 6,500 acres will be flooded in Bahia Grande under this alternative, 4,000 permanently, and 2,500 tidally. In addition, 1,669 acres in Laguna Larga would be flooded, either by freshwater from the NRCS diversions under State Highway 100, or by saltwater from Bahia Grande. Another 1,411 acres will be inundated in Little Laguna Madre under this alternative. Therefore a total of approximately 9,580 acres will be flooded, either permanently (4,000-plus acres) or periodically by lunar and wind tidal effects (2,500-plus acres).

Appendix D contains drawings of these channels, both cross-sectional and longitudinal. There is also a topographic view of the entire project.

All of this additional water is habitat for shrimp, crabs, shellfish and other invertebrates, and finfish, which in turn provide a rich feeding source for shorebirds, wading birds, and waterfowl. Additional water would be better aerated, and seagrasses and other plants would experience much greater success. As a result, under Alternative IV, there should occur higher survivability, reproduction, and density of marine organisms than in either of the prior alternatives, II or III, which, in turn, would provide a richer feeding site for greater numbers of shorebirds, wading birds, waterfowl, osprey, and other species.

Channel construction will generate spoil material. If transport of the spoil by heavy truck across the dry basin is feasible, spoil islands may be created. These spoil islands will be shaped to retain as much material as possible in high wind situations, and are expected to prove valuable as nesting areas for colonial water birds. Historically, two small islands within Bahia Grande provided nesting habitat for over 10,000 terns, gulls, and black skimmers. Restoring this type of habitat would be a secondary goal of the project.

Additional possibilities for the disposal of spoil from the channel construction process are use by the Brownsville Landfill for "capping debris" with soil, and by TXDOT for use in the roadbed of an expanded State Highway 48.

4.5.1 Climate

This alternative will not have an effect on climate.

Drought will continue to cause some adverse impacts to some wildlife species and their habitats, although these impacts may be ameliorated by the reduction of blowing dust caused by the filling of the basins.

4.5.2 Air Quality

Under this alternative, air quality would improve. Blowing dust would still account for most of the particulate matter in the region's air, but it would be reduced in the Bahia Grande area by restoring a tidal hydrological pattern to flood the dry basin. A traffic hazard may still be occasionally present in the form of blowing dust across State Highway 100, but would be much reduced. The major source of blowing dust would be eliminated, representing perhaps 60% of the total problem. Additional dust will still come from Long Island, from the sides of the Brownsville Ship Channel, and from U.S. Army Corps of Engineers spoil areas in the vicinity.

4.5.3 Geology and Soils

There would be an effect to geology and soils in the area. Silt and sand would continue to be wind transported, but these effects would be reduced in the Bahia Grande area by restoring a

tidal hydrological pattern to flood the dry basin. Dust storms that adversely affect Laguna Vista, Laguna Heights, and Port Isabel would be reduced in severity.

Positive beneficial effects on loma vegetation have already been addressed. In addition, some of the soils removed in digging this channel, if appropriate, will be used to "patch" eroded gullies and other damage to the existing lomas. This should stabilize the erosion problem, conserve the topsoil, and encourage colonization by various plant species, which will further stabilize the areas.

4.5.4 Water Resources

Restoring tidal hydrological patterns in these waters would greatly increase wildlife and fishery resources and may provide additional recreational opportunities. The exchange of salt water would contribute to improving water circulation in the Bahia Grande. This alternative alone will provide circulation and water mixing to maintain the system at maximum biological productivity. It is more efficient than either Channels A or E alone.

A total of about 6,500 acres will be flooded in Bahia Grande under this alternative, 4,000 permanently, and 2,500 tidally. In addition, 1,669 acres in Laguna Larga would be flooded, either by freshwater from the NRCS diversions under State Highway 100, or by saltwater from Bahia Grande. Another 1,411 acres will be inundated in Little Laguna Madre under this alternative. Therefore a total of approximately 9,580 acres will be flooded, either permanently (7,080 acres) or daily by lunar and wind tidal effects (2,500 acres).

Appendix D has drawings of these channels, both cross-sectional and longitudinal. There is also a topographic view of the entire project.

The effects of this Preferred Alternative, while similar to those for Channels A and E, will, by virtue of its combination of both, provide for faster inflows and exodus of water inside the basin. This may be of special importance during times of heavy rainfall events.

4.5.5 Biological Resources

Habitat for wading birds, shorebirds, and threatened species like the piping plover would be enhanced under this alternative. Migration of marine organisms into and out of the Bahia Grande would be possible. Biological productivity will be significantly increased. In addition to the obvious habitat provision for shrimp, crabs, shellfish and other invertebrates, and finfish, these will provide a rich feeding source for shorebirds, wading birds, and waterfowl.

As mentioned above, various grants, universities, and proposed studies, will evaluate the effects of flooding on both plant and animal species in the Bahia Grande system.

The alleviation of the dust problem and restoration efforts creating an attractive wetland may also increase development and market value for properties near the Bahia Grande. This could have a detrimental effect on biological resources on private lands near the Bahia Grande as rural properties are developed and native habitat for wildlife is destroyed. Species impacted with such an urbanization scenario might include Texas tortoise, Texas horned lizard, plain chachalaca, white-tipped dove, Harris' hawk, ladder-backed woodpecker, green jay, great kiskadee, altamira oriole, olive sparrow, bobcat, ocelot, jaguarundi, javelina, and white-tailed deer.

4.5.6 Cultural Resources

Protection of cultural resources would continue.

4.5.7 Land Use

The Bahia Grande would be partially restored to a historical natural condition. Recreational use of the Bahia Grande area would be greatly enhanced under this alternative.

The flooding of Bahia Grande will provide a rich study site for universities. Already the University of Texas Pan-American has submitted a proposal to the National Oceanic and Atmospheric Administration (NOAA) to fund a study of seagrasses colonizing the flooded basins, as well as the potential for introducing black mangroves and seagrasses to the site, (Don Hockaday, pers. comm.). Texas A&M University-Kingsville has contacted the Service about doing studies of changes in the upland habitats as a result of flooding Bahia Grande, looking at the plant and animal communities, to assess the changes that occur therein (Bill Kuvlesky, pers. comm.). Texas A&M University-Corpus Christi is preparing a funding proposal to assess the complex issue of marine organism colonization, including both plant and animal species (Wes Tunnel and Liz Smith, pers.comm.)

Another grant from EPA is available for award to a research entity for evaluation of the effects of flooding on marine plant and animal resources.

The Service has an interest in encouraging more northern aplomado falcons on the site, through improvement of the habitat, and would also support the natural proliferation of plant life, re-vegetation of denuded loma sites, and stabilization of all wildlife populations native to the site.

The Preferred Alternative differs from Alternatives II and III in that it will provide a much greater circulation and aeration of waters in Bahia Grande, Laguna Larga, and Little Laguna Madre. This will result in a proliferation of plant and animal life in the aquatic habitat, and the permanent flooding with tidal waters will benefit upland plants and wildlife on lomas and other sites by suppressing the windblown, salty dust that heretofore has impacted negatively the plants and wildlife thereon.

4.5.8 Socioeconomic Resources

The area surrounding the Bahia Grande would continue to follow a trend of increased urbanization. Under this alternative, land values would change only as the local markets are affected by future trends. Market values might increase due to anticipated increased development in areas such as along State Highway 100 and close to towns. The alleviation of the dust problem may also increase development and market value for properties near the Bahia Grande. Also, and related to the urbanization problem, but in a positive sense, nature tourism and other recreational activities will increase under this alternative due to the increase in wildlife resources, commensurate with the increased human population. This is likely to positively impact the local economy (Pete Moore, South Padre Island Development Council, pers. comm., and Patrick Marchan, Port Isabel Mayor, pers. comm.).

In addition, commercial and recreational fisheries will be enhanced by restoration of estuarine nursery habitat for shellfish and finfish.

4.5.8.1 Effects on Tax Revenues

There should be no effect.

4.5.9 Public Use and Recreation

Opportunities for wildlife-oriented recreation under this alternative will be positive for the general public. The restoration of the Bahia Grande will increase wildlife viewing opportunities, such as birdwatching. Additional public uses, including the "Big Six" priority public uses on national wildlife refuges: hunting, fishing, wildlife observation, photography, environmental education, and interpretation, will be explored. The development of the CCP will include several public meetings to allow the public to propose and comment on potential public recreational uses for the Bahia Grande Unit.

4.5.10 Contaminants and Hazardous Waste

No change in levels of contaminants or hazardous waste is expected. However, because of the connection to the Brownsville Ship Channel, there would be potential for the introduction of toxic chemicals into the Bahia Grande due to a spill. The refuge maintains a supply of booms, suits, and other gear to be used by the U.S. Coast Guard (lead agency) and other cooperators, in case of a spill. The refuge Spill Contingency Plan will be updated prior to flooding the basins.

5.0 Unexpected Impacts - Controlled/Minimized

Unexpected impacts are likely to come from urbanization around the communities of Port Isabel, Laguna Heights, and Laguna Vista. To reduce negative impacts from this source, the Service

will maintain frequent communications with the county judge, mayors, and town councils of these three communities.

6.0 Refuge Oversight

The Bahia Grande Unit is a part of the National Wildlife Refuge System, and is managed by the Refuge Manager of the Laguna Atascosa National Wildlife Refuge, which is part of the South Texas Refuge Complex.

7.0 Environmental Justice Issues

No negative impacts are anticipated under Environmental Justice Issues. The significant reduction of blowing dust, negatively impacting local communities, will be a beneficial impact of this project on Environmental Justice Issues. The towns of South Padre Island, Port Isabel, Laguna Heights, Laguna Vista, Bayview, and Los Fresnos, will all experience an increase in quality of life, due to the effect of this project in reducing blowing dust.

8.0 Permits Required

8.0.1 U.S. Army Corps of Engineers: Section 404 Permit

8.0.2 Texas Historic Preservation Office: Concurrence with the Proposed Project

8.0.3 Texas Council on Environmental Quality: Concurrence

8.0.4 National Environmental Policy Act: Compliance

9.0 Public Comments

The Service will provide an opportunity for the public to comment on this proposed action. A 30-day comment period, during which the Service will accept written comments, will feature a public meeting, to be held in the vicinity of Port Isabel. The purpose of the 30-day comment period and this public meeting will be to solicit public opinion about the project, as described in the final "draft" EA. Comments received will be carefully considered, and incorporated in the body of the final EA, as their content merits.

10.0 Cumulative Impacts

The only other federal action in the foreseeable future is the proposed improvements on State Highway 48, which runs between Brownsville and Port Isabel. The Texas Department of Transportation proposes to widen this road, from its present two-lane status to a four-lane highway with shoulders. This road improvement will include construction of an approximately

240-foot wide bridge to span the channel connecting Bahia Grande directly to the Brownsville Ship Channel. Initially, the Brownsville Navigation District, in cooperation with the Texas Department of Transportation, may construct a "pilot channel", smaller than the final one (Channel E). If constructed, this planned "pilot channel" will cross under State Highway 48 via a series of new culverts to be installed by the Texas Department of Transportation.

11.0 Mitigation

Placement of fill will be mitigated for by the extent of wetlands to be restored by the project. Approximately 4,130,680 cubic feet of fill material will be excavated in digging the proposed channels A, B, C, and D. In return, approximately 19,160 acre/feet of tidal water will cover approximately 9,580 acres of bay bottoms as follows: 6,500 acres in Bahia Grande, 1,669 acres in Laguna Larga, and 1,411 acres in Little Laguna Madre. This trade off of fill material to acres flooded is believed to be beneficial to wildlife and wetland resources when the overall project is considered. In addition, the restored wetlands will be covered with permanent, tidal water, while the areas covered by fill are ephemeral wetlands covered intermittently with rain water.

12.0 Document Preparation

This document has been drafted by personnel of the South Texas Refuge Complex, Region 2, U.S. Fish and Wildlife Service, U.S. Department of Interior. Primary responsibility for writing this document was given to Stephen E. Labuda, Jr. The initial draft of the document was prepared by Marie Fernandez. Others who offered significant help in fine-tuning the Environmental Assessment were Ken Merritt, David Blankinship, John D. Wallace, Ernesto Reyes (Santa Ana Ecological Services Office), and Tim Cooper (Mackay Island NWR). Additional significant assistance came from Pat Clements at the Corpus Christi Ecological Services Office.

13.0 Other Federal Agencies Consulted

The following list entails the other Federal Agencies consulted during the course of writing this draft Environmental Assessment:

Natural Resource Conservation Service, U.S. Department of Agriculture
U.S. Army Corps of Engineers, Department of the Army
Office of Congressman Solomon Ortiz, Congress of the United States of America
National Oceanic and Atmospheric Administration, U.S. Department of Commerce

APPENDIX A: REFERENCES

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Eye on Nature, a publication of the Nongame and Urban Program, Texas Parks and Wildlife Department, 1995.

Morton, R.A. 1991. Physical evaluation of proposed flooding of Bahia Grande, Cameron County, Texas. Bureau of Economic Geology, University of Texas, Austin, Texas. 13pp.

Natural Resource Conservation Service. 2002. Topographic map and channel sectionals for Bahia Grande WRP. USDA. 6 pp., one over-size.

U.S. Fish and Wildlife Service. 1999. Laguna Atascosa National Wildlife Refuge - Proposed Refuge Expansion Plan (Environmental Assessment and Conceptual Management Plan). 63 pp.

Van Valkenburg, Dianna L., and Billy L. Edge. February 2003. Analysis of Proposed Flooding of Bahia Grande, Cameron County, Texas. A Thesis. Ocean Engineering Program, Civil Engineering Department, Texas A&M University, College Station, Texas 77843-3136.

APPENDIX B: LETTERS OF SUPPORT

N.B. Letters of support will be published in their entirety after the public review process has been completed. Here they are only referenced in the order in which they have been received.

1. Letter from Tim Fitch, of James A. Dougherty Properties, P. O. Box 640, Beeville, Texas, 78104-0640. Expressing support of the Garcia family for the proposed flooding of Bahia Grande, Laguna Larga, and Little Laguna Madre. Dated 14 February 2002. This letter will be included as a part of this document after the period for public comment has been concluded.

APPENDIX C: HISTORIC DOCUMENTS

1. Reprint of a 1945 newspaper article, in 2002, :

   Dust has always been a problem for Port Isabel, and in 1945 some action was taken to control the dust. In the Wednesday, November 14, 1945 edition of *The Port Isabel Pilot*, an article describing this nuisance ran, as follows:

   "Definite Action Taken to Control Dust Nuisance

Definite action was taken by the Directors of the Port Isabel Chamber of Commerce to abate the dust that at intervals in recent years has been not only a scourge to the people but a health menace as well.

Earl Long was employed to put the present pump in working order and execute plans for, if not completely eliminating the dust nuisance, to at least control it. The present levees about the spoil banks between the South channel and ship channel are to be strengthened and made higher. A flood gate is to be installed and so arranged that when these flats are covered during high tide, the gate can be closed, retaining this water within the confines of the dykes.

To finance this project, estimated to cost not less than $300, business institutions and individuals will be called upon to donate. A "Dust Bowl Committee" composed of E. W. "Fritz" Edwards, chairman, Flem L. Marlin, and James J. Jaudon was appointed to contact business institutions and others to raise the necessary amount to complete this project.

"These funds are to be kept separate and apart from those of the Chamber of Commerce and are to be used exclusively in the matter of dust control", so stated Secretary Stuart Adkins."

2. Unfortunately, this attempt in 1945 was not successful in controlling the dust problem, as attested to by the following letter from the Point Isabel Independent School District, dated June 25, 2001.

"RE: Environmental Restoration and Enhancement Project

Mr. Labuda,

Allow me to express my gratitude for meeting with me and having other staff meet with our administrators, Mr. Raul Villareal and Dr. Estella Guetzow and for addressing a serious and hazardous situation that we currently have in our school district. I would certainly like to see the sandy area behind our Port Isabel Junior High flooded; I understand that a channel will efficiently flood that zone. Frankly, it is critical that some type of action take effect.

The current condition of the blowing sand on a daily basis creates a hazardous situation for our students and the air quality in the school. The results are highly detrimental: sick buildings and ill student and staff members. Our schools staff are already feeling the effects of this hazardous situation. The Junior High playground is profoundly affected as well; there is no recreational area for the students due to the sand dunes that accumulate in this area. In addition, the past three years and to date, we have working on improving the air quality of our schools by fixing and redoing our whole HVAC (Heating, Ventilating, and Air Conditioning) systems. We have spent approximately five million dollars in this improvement effort. However, our engineers have advised us that

the sandy conditions of this area will cause severe harm to the improvements that we are making; thus, possibly throwing away tax dollars that are important to our community.

Furthermore, some of our students are frail and have special needs. Some of these children can get very ill if our air quality diminishes and if the sand conditions of our playgrounds and surrounding areas continues to deteriorate. I have witnessed these situations in these past two years. We are extremely concerned about the health of our students and employees and in protecting the investment of our taxpayers. I believe that this situation needs immediate attention in order to avoid future litigation and significant health problems.

It is, therefore, urgent that the County, State, and all entities affected, find a remedy to our duster-sand control for Port Isabel, particularly the areas surrounding our schools. Please keep us informed as a partnership in this worthwhile health related issue.

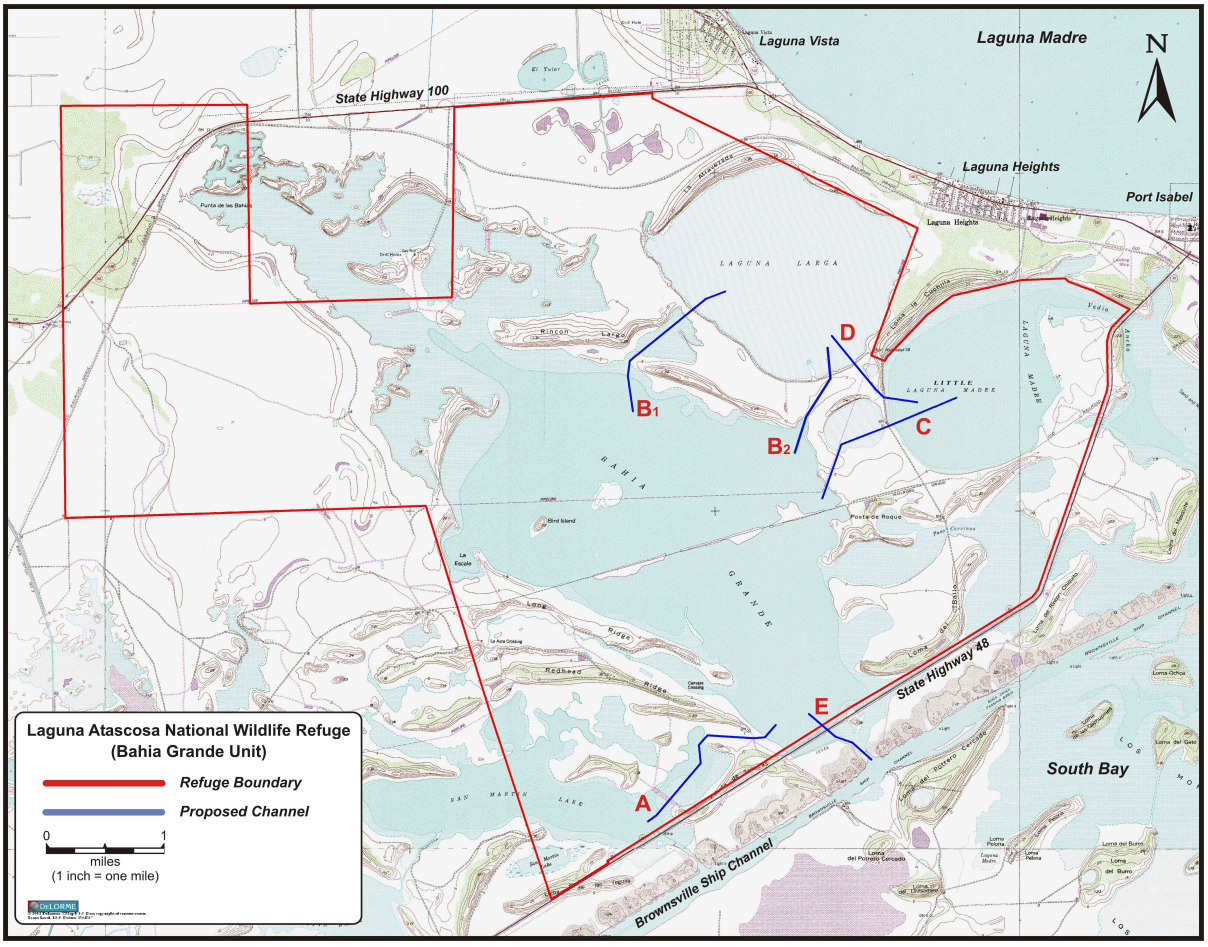
Sincerely,

s/
Dr. Dolores Munoz
Superintendent

Xc: Robert Cornelison *Raul Besteiro*
Raul Villareal *Daniel L. Rentfro, Jr."*

The carbon copy addressees in this letter are: (1) Robert Cornelison, Director of the Port Isabel/San Benito Navigation District, (2) Raul Villareal, Maintenance Supervisor for the Point Isabel School District, (3) Raul Besteiro, Director of the Brownsville Navigation District, and (4) Daniel L. Rentfro, Jr., Attorney for the Brownsville Navigation District.

APPENDIX D: TOPOGRAPHICAL MAP AND SECTIONAL VIEWS OF CHANNELS



Topographic map (USGS) overview of the Bahia Grande Project area. General location is between Port Isabel and Brownsville, along State Highway 48, and between Port Isabel and Los Fresnos, along State Highway 100.